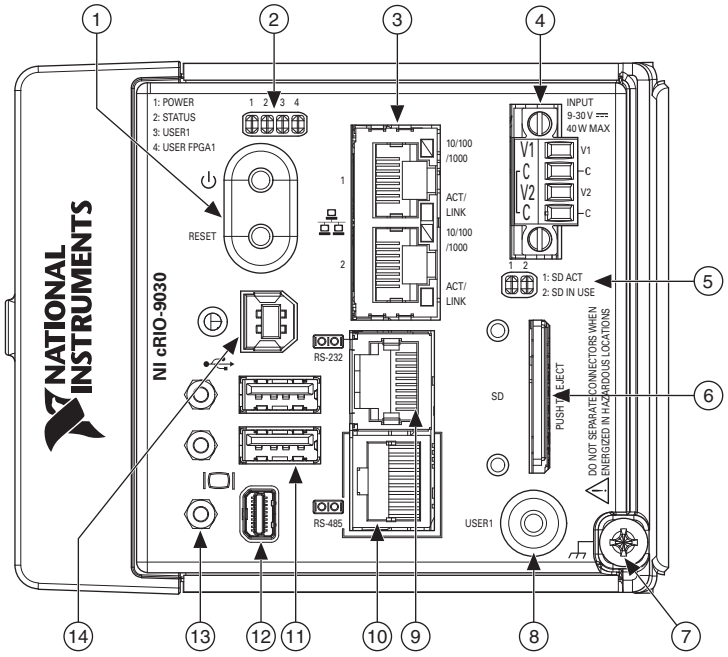
GETTING STARTED GUIDE

NI cRIO-9030

Embedded CompactRIO Controller with Real-Time Processor and Reconfigurable FPGA

Figure 1. cRIO-9030 Front Panel



1	RESET and Power Buttons	6	SD Card Slot	11	USB Host Ports
2	LEDs	7	Grounding Screw	12	Mini DisplayPort
3	RJ-45 Ethernet Ports	8	User1 Button	13	Retention Mounts for Mini DisplayPort and USB Ports
4	Power Connector	9	RS-232 Serial Port		
5	SD Indicator LEDs	10	RS-485 Serial Port	14	USB Device Port

This document describes how to connect the cRIO-9030 to a host computer, install software on the cRIO-9030, and start using the cRIO-9030.

For information about ports, pinouts, specifications, and mounting the cRIO-9030, refer to the *NI cRIO-9030 Operating Instructions and Specifications* on ni.com/manuals.

NATIONAL INSTRUMENTS

Safety Guidelines

Caution Do *not* operate the cRIO-9030 in a manner not specified in this document. Product misuse can result in a hazard. You can compromise the safety protection built into the product if the product is damaged in any way. If the product is damaged, return it to National Instruments for repair.

Safety Guidelines for Hazardous Locations

The cRIO-9030 is suitable for use in Class I, Division 2, Groups A, B, C, D, T4 hazardous locations; Class 1, Zone 2, AEx nA IIC T4 and Ex nA IIC T4 hazardous locations; and nonhazardous locations only. Follow these guidelines if you are installing the cRIO-9030 in a potentially explosive environment. Failure to follow these guidelines may result in serious injury or death.

Caution Do *not* disconnect the power supply wires and connectors from the controller unless power has been switched off.

Caution Substitution of components may impair suitability for Class I, Division 2.

Caution For Zone 2 applications, install the CompactRIO system in an enclosure rated to at least IP 54 as defined by IEC 60529 and EN 60529.

Caution Do *not* insert or remove SD cards unless power has been switched off or the area is known to be nonhazardous.

Caution The USB host ports, USB device port, mini DisplayPort, and SD card slot require the retention accessories listed in Table 1 for hazardous locations. All cables must be used in a conduit or cable gland to wire to a nonhazardous location. Do *not* disconnect a cable unless the cRIO-9030 is powered off or the area is known to be nonhazardous.

Table 1. Hazardous Location Retention Accessories

Port	Required Accessory	NI Part Number
Mini DisplayPort	Mini DisplayPort Cable Retention Bracket	156866-01
SD Card Slot	SD Door Kit	783660-01
USB Device Port	NI Locking USB Cable	157788-01
USB Host Port	NI Industrial USB Extender Cable	152166-xx

Special Conditions for Hazardous Locations Use in Europe

Some chassis have been evaluated as Ex nA IIC T4 Gc equipment under DEMKO Certificate No. 12 ATEX 1202658X. Each such chassis is marked ⟨Ex⟩ II 3G and is suitable for use in Zone 2 hazardous locations, in ambient temperatures of -20 ≤ Ta ≤ 55 °C.

Caution You *must* ensure that transient disturbances do not exceed 140% of the rated voltage.

Caution The system must be mounted in an ATEX certified enclosure with a minimum ingress protection rating of at least IP 54 as defined in IEC/EN 60529 and used in an environment of not more than Pollution Degree 2.

Caution The enclosure must have a door or cover accessible only by the use of a tool.

Electromagnetic Compatibility Guidelines

This product was tested and complies with the regulatory requirements and limits for electromagnetic compatibility (EMC) stated in the product specifications. These requirements and limits provide reasonable protection against harmful interference when the product is operated in the intended operational electromagnetic environment.

This product is intended for use in industrial locations. However, harmful interference may occur in some installations, when the product is connected to a peripheral device or test object, or if the product is used in residential or commercial areas. To minimize interference with radio and television reception and prevent unacceptable performance degradation, install and use this product in strict accordance with the instructions in the product documentation.

Furthermore, any modifications to the product not expressly approved by National Instruments could void your authority to operate it under your local regulatory rules.

Caution To ensure the specified EMC performance, product installation requires either special considerations or user-installed, add-on devices. Refer to the *Grounding the Chassis* and *Wiring Power to the cRIO-9030* sections for more information.

Caution To ensure the specified EMC performance, operate this product only with shielded cables and accessories. Note that the input DC power cables may be unshielded.

Caution To ensure the specified EMC performance, the length of any cable connected to the video and V2 ports must be no longer than 3 m (10 ft); the length of any cable connected to the USB Host, RS-232 and RS-485 ports must be no longer than 30 m (100 ft).

Caution The USB device port is intended only for use in device configuration, application deployment, debug, and maintenance.

Special Guidelines for Marine Locations

Some products are Lloyd's Register (LR) Type Approved for marine (shipboard) applications. To verify Lloyd's Register certification for a product, visit `ni.com/certification` and search for the LR certificate, or look for the Lloyd's Register mark on the product label.

Caution In order to meet the EMC requirements for marine applications, install the product in a shielded enclosure with shielded and/or filtered power and input/output ports. In addition, take precautions when designing, selecting, and installing measurement probes and cables to ensure that the desired EMC performance is attained

What You Need to Get Started

☐ The NI cRIO-9030 shipping kit, which includes the following components:

- NI cRIO-9030 controller
- NI-RIO Device Driver CD

Note NI-RIO 14.0 is the earliest supported driver for the cRIO-9030.

- Two ferrites
- SD card slot cover
- Power screw terminal connector plug
- A-to-B device port USB cable

Caution National Instruments requires the use of a locking USB cable, such as part number 157788-01, in order to meet the shock and vibration specifications of this product.

☐ A host computer running Windows, with NI software installed in the following order:

Note Visit `ni.com/info` and enter the Info Code `rdsoftwareversion` to determine which software versions you need to use the cRIO-9030 and supported C Series modules. LabVIEW 2014, LabVIEW RT 2014, and LabVIEW FPGA 2014 are the earliest supported software versions for the cRIO-9030.

- LabVIEW
- LabVIEW RT
- LabVIEW FPGA (recommended)
- NI-RIO Device Driver

☐ A DC power supply as described in the *Power Requirements* section of the *NI cRIO-9030 Operating Instructions and Specifications*

☐ C Series I/O modules (optional)

- ☐ A number 2 Phillips screwdriver
- ☐ A number 1 Phillips screwdriver
- ☐ A small flat-blade screwdriver
- ☐ Ethernet cable (optional)

Preparing the Environment

Ensure the environment where you are using the controller meets the following specifications.

Operating temperature
(IEC 60068-2-1, IEC 60068-2-2) ..... -20 °C to 55 °C

Operating humidity (IEC 60068-2-56) ..... 10% to 90% RH, noncondensing

Pollution Degree 2

Maximum altitude..... 5,000 m

Indoor use only.

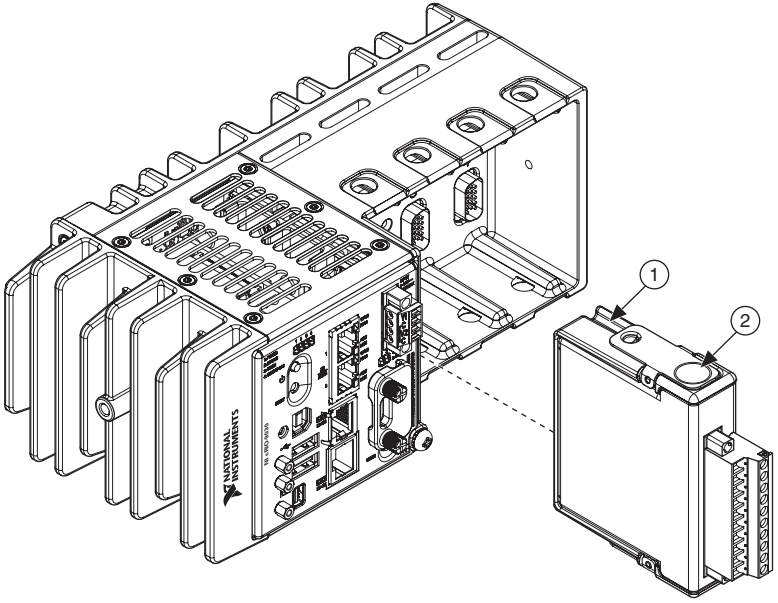
Note Refer to the *NI cRIO-9030 Operating Instructions and Specifications* on `ni.com/manuals` for complete specifications.

Installing C Series I/O Modules in the Chassis

Complete the following steps to install a C Series I/O module in the chassis.

1. Ensure no I/O-side power is connected to the I/O module. If the system is in a nonhazardous location, the chassis can be powered on when you install I/O modules.
2. Align the I/O module with an I/O module slot in the chassis as shown in Figure 2. The module slots are labeled 1 to 4, left to right.

Figure 2. Installing an I/O Module in the cRIO-9030



1	Insertion Groove	2	Latch

3. Squeeze the latches and insert the I/O module into the module slot.
4. Press firmly on the connector side of the I/O module until the latches lock the I/O module into place.
5. Repeat these steps to install additional I/O modules.

Removing I/O Modules from the Chassis

Complete the following steps to remove a C Series I/O module from the chassis.

1. Ensure no I/O-side power is connected to the I/O module. If the system is in a nonhazardous location, the chassis can be powered on when you remove I/O modules.
2. Squeeze the latches on both sides of the module and pull the module out of the chassis.

Grounding the Chassis

You must connect the chassis grounding terminal to the grounding electrode system of the facility. Complete the following steps to ground the chassis:

1. Attach a ring lug to a 1.31 mm^2 (16 AWG) or larger wire.
2. Remove the grounding screw from the grounding terminal on the front of the chassis. Refer to Figure 1 for the location of the grounding screw.
3. Attach the ring lug to the grounding terminal.
4. Tighten the grounding screw to 0.5 N · m (4.4 lb · in.) of torque.
5. Attach the other end of the wire to the grounding electrode system of your facility using a method appropriate for the application.

Caution If you use shielded cabling to connect to a C Series I/O module with a plastic connector, you must attach the cable shield to the chassis grounding terminal using 1.3 mm^2 (16 AWG) or larger wire. Attach a ring lug to the wire and attach the wire to the chassis grounding terminal. Solder the other end of the wire to the cable shield. Use shorter wire for better EMC performance.

For more information about ground connections, go to `ni.com/info` and enter the Info Code `emcground`.

Wiring Power to the cRIO-9030

The cRIO-9030 requires a 9 to 30 V external power supply that meets the specifications in the *Power Requirements* section of the *NI cRIO-9030 Operating Instructions and Specifications*. The cRIO-9030 filters and regulates the supplied power and provides power for the I/O modules.

The cRIO-9030 has a primary power input, V1, and a secondary power input, V2. The POWER LED on the front panel identifies the power input in use. When the LED is lit green, V1 is in use. When the LED is lit yellow, V2 is in use.

The cRIO-9030 has reverse-voltage protection.

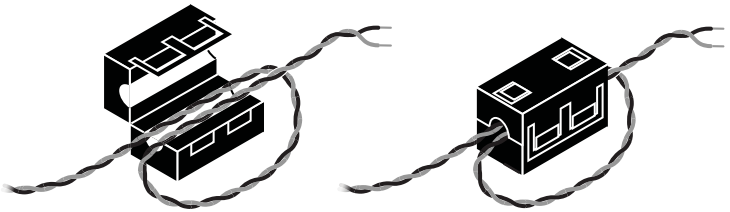
Caution Do *not* connect V2 to a DC mains supply or to any supply requiring a connecting cable longer than 3 m (10 ft). A DC mains supply is a local DC electricity supply network in the infrastructure of a site or building.

Complete the following steps to connect a power supply to the controller.

1. Ensure the power source is turned off.

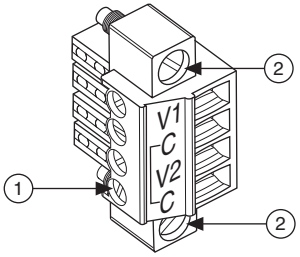
2. Install the ferrite, (National Instruments part number 711849-01, included in the shipping kit) across the negative and positive leads of the power source, approximately 50 to 75 mm (2 to 3 in.) from the end of the power input wires, as shown in Figure 3.

Figure 3. Installing a Ferrite on the Power Leads



3. Loosen the connector screw flanges and remove the power screw terminal connector plug from the cRIO controller. Figure 4 shows the terminal screws, which secure the wires in the screw terminals, and the connector screw flanges, which secure the connector plug on the front panel.

Figure 4. Power Screw Terminal Connector Plug



1	Terminal Screw	2	Connector Screw Flanges

Caution Do *not* tighten or loosen the terminal screws on the power connector while the power is on.

4. Connect the positive lead of the primary power source to the V1 terminal of the power connector plug and tighten the terminal screw to 0.20 to 0.25 N · m (1.8 to 2.2 lb · in.) of torque.
5. Connect the negative lead of the power supply to one of the C terminals of the power connector and tighten the terminal screw to 0.20 to 0.25 N · m (1.8 to 2.2 lb · in.) of torque.
6. Optionally, you can connect the positive lead of another power supply to the V2 terminal and the negative lead to the other C terminal.

Caution The C terminals are internally connected to each other.

7. Install the power connector on the front panel of the cRIO controller and tighten the connector screw flanges to 0.3 to 0.4 N · m (2.7 to 3.5 lb · in.) of torque.
8. Turn on the external power source(s).

Note Refer to the *NI cRIO-9030 Operating Instructions and Specifications* on `ni.com/manuals` for a complete description of power inputs and controller startup options.

Powering On the cRIO-9030

When you apply power for the first time to the cRIO-9030, the controller boots into safe mode. The POWER LED illuminates, the STATUS LED illuminates briefly, and then the STATUS LED blinks twice every few seconds.

Note Refer to the *Understanding LED Indications* section for more information on STATUS LED indications.

You can configure the cRIO-9030 to launch an embedded stand-alone LabVIEW RT application each time you boot the controller. Refer to the *Running a Stand-Alone Real-Time Application (RT Module)* topic of the *LabVIEW Help* for more information.

Note Refer to the *NI cRIO-9030 Operating Instructions and Specifications* for information about autoloading a bitfile at startup.

Connecting the cRIO-9030 to the Host Computer

Power on the host computer. Use a USB A-to-B cable, included in the shipping kit, to connect the USB device port of the cRIO-9030, shown in Figure 1, to the host computer.

Caution National Instruments requires the use of a locking USB cable, such as part number 157788-01, in order to meet the shock and vibration specifications of this product.

Note Alternatively, you can use the RJ-45 Ethernet port to connect the cRIO-9030 to the host computer. Refer to the *NI cRIO-9030 Operating Instructions and Specifications* for more information about cRIO-9030 Ethernet connection.

The device driver software automatically detects the controller. If the device driver software does not detect the controller, refer to the *What You Need to Get Started* section and verify that you installed the appropriate NI software in the correct order on the host computer before trying again.

Configuring the System in Measurement & Automation Explorer (MAX)

After connecting the cRIO-9030 to the host computer, complete the following steps to configure the system for the first time in MAX:

1. Launch NI MAX on the host computer.
2. Expand **Remote Systems** in the MAX configuration tree and select the system. MAX lists the system as the model name followed by the serial number, such as **NI-CRIO-9030-1856AAA**.

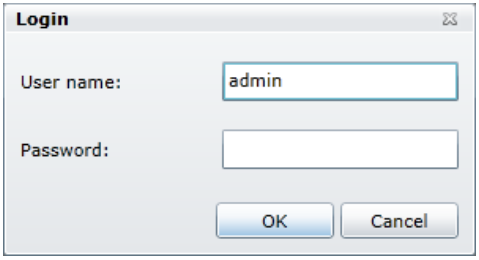
Note If you cannot find the system in the MAX configuration tree, refer to the *Troubleshooting Network Communication* section.

Setting a System Password

1. Right-click the system under **Remote Systems** and select **Web Configuration**. The **Web Configuration** window appears in a browser.
2. Optionally, you can enter a descriptive name for the system in the **Hostname** field. A descriptive name makes it easier to find the system on a network with other devices.
3. Click the **Security Configuration** icon on the left.

The **Security Configuration** window appears.

4. Click **Login** at the top right.
5. Enter **admin** as the user name, leave the **password** field blank, and click **OK**.



6. Click **Change Password**.
7. Enter and re-enter the new password, click **OK**, then click **Save**. A message appears warning that the password is changing and you must login again. Click **OK**.

Note If you forget the system password, you must use the information in the *Worldwide Support and Services* section to contact NI and reformat the controller. NI cannot recover lost system passwords.

Installing Software on the cRIO-9030

1. Return to MAX and expand the system under **Remote Systems** by clicking the arrow beside it.
2. Select **Software**.
3. Click **Add/Remove Software** at the top of the **Software** tab to launch the LabVIEW Real-Time Software Wizard.

Note A login window appears if you set a system password.

4. Select a recommended software set to install.
5. Click **Next**.
6. Select **NI Scan Engine** from the software add-ons

Note You can use the LabVIEW Real-Time Software Wizard to install more software add-ons later. The Recommended Software Set with the NI Scan Engine add-on is enough to get started with CompactRIO.

7. Click **Next**.
8. Review the summary of software to install. Click **Next** to begin the update.
9. Wait for the installation to finish, then click **Finish**.

Note If you interrupt the software installation process, the cRIO-9030 may be in an unusable state. You must format the hard drive and go through the installation process again. Refer to the *NI cRIO-9030 Operating Instructions and Specifications* for information about how to format the hard drive.

Adding the cRIO-9030 to a LabVIEW Project

1. Launch LabVIEW. The LabVIEW Getting Started window appears.
2. Click **Create Project**.
3. **Blank Project** should already be selected on the right side of the **Create Project** dialog that appears. Click **Finish**.

Note Alternatively, you can select **Sample Projects»CompactRIO** on the left, then select one of the sample CompactRIO projects to explore. However, creating a blank project is simpler for now.

4. On the **Project Explorer** window that appears, right-click the top-level **Project** item, then select **New»Targets and Devices**.
5. On the **Add Targets and Devices** window that appears, expand **Real-Time CompactRIO**. LabVIEW lists the system as the model name followed by the serial number, such as **NI-CRIO-9030-1856AAA**. Select the cRIO-9030 and click **OK**.
6. On the **Select Programming Mode** dialog that appears, click **Continue**. The cRIO-9030 now appears as part of the project in the **Project Explorer** window.
7. You can expand the cRIO-9030 item by clicking the + sign beside it.

Where to Go from Here

Once you discover the cRIO-9030 in LabVIEW and add the CompactRIO system to a project, you can begin developing applications. Refer to the following resources as you learn to use CompactRIO in LabVIEW:

- *NI cRIO-9030 Operating Instructions and Specifications*—This document provides additional information such as complete descriptions of ports, pinouts, specifications, Ethernet connection, and mounting configurations of the cRIO-9030.
- *C Series Module Getting Started Guides*—These documents explain how to connect sensors, actuators, and other devices to C Series modules.
- *Getting Started with NI Products*—The `ni.com/gettingstarted` portal includes videos and tutorials that are helpful for starting a new LabVIEW application. Visit `ni.com/info` and enter the Info Code `NewLVApp`.
- *LabVIEW Help*—These help files contain information about using NI products in LabVIEW. In LabVIEW, select **Help»LabVIEW Help.** Go the index or search tab of the help and enter `9030` to show product-specific help for the controller.
- *NI CompactRIO Developer's Guide*—This online guide provides an overview of recommended architectures and development practices. You can find the *NI CompactRIO Developer's Guide* at `ni.com/compactriodevguide`.
- *Sample CompactRIO Projects*—These projects include deterministic control, waveform acquisition, and datalogging. You can find sample CompactRIO projects on the **Create Project** dialog in LabVIEW.

Troubleshooting Network Communication

What to Do if the cRIO-9030 Cannot Communicate with the Network

If the cRIO controller cannot communicate with the network, you can perform the following troubleshooting steps.

1. Use a USB A-to-B cable to connect the cRIO controller USB device port, shown in Figure 1, to a host computer.

   When you connect the cRIO controller to the host computer, the USB driver creates a virtual network interface card and assigns an IP address to the cRIO controller in the format of `172.22.11.x`.
2. Launch NI MAX. Expand Remote Systems in the MAX configuration tree and select the system. MAX lists the system as the model name followed by the serial number, such as **NI-CRIO-9030-1856AAA**. Select the **Network Settings** tab to configure the IP and other network settings.
3. (Optional) At this point, you can use the RJ-45 Ethernet port 1 to reconnect the cRIO controller to the host computer. The cRIO controller attempts to initiate a DHCP network connection at powerup.

   If the cRIO controller is unable to obtain an IP address, it connects to the network with a link-local IP address with the form `169.254.x.x`. The host computer communicates with the cRIO controller over a standard Ethernet connection.

To reset your Windows firewall settings, complete the following steps.

1. Hold the RESET button down for 5 seconds, then release it. The STATUS LED turns on, then starts blinking three times every few seconds. The controller is now in safe mode with output from the serial port enabled. You can use a RS-232 serial port terminal to read the IP address of the controller or you can connect a monitor to the mini DisplayPort and view the IP address.
2. To set a new DHCP connection, hold the RESET button down for 5 seconds, then release it. The STATUS LED repeats the same behavior. The cRIO controller attempts to establish a new DHCP connection. If the controller fails, it assigns itself a link-local IP address. If the DHCP connection is successful and appropriate for your application, skip to step 4.
3. Launch MAX. Expand Remote Systems in the MAX configuration tree and select the system. MAX lists the system as the model name followed by the serial number, such as **NI-CRIO-9030-1856AAA**. Select the **Network Settings** tab to configure the IP and other network settings.
4. Press and release the RESET button to reboot the controller.

What to Do If You Cannot Find the cRIO-9030 in MAX

If you cannot find the cRIO-9030 in MAX, try the following actions:

- Ensure you have the correct version of NI-RIO installed on the host computer. Go to `ni.com/info` and enter the Info Code `rdsoftwareversion` for the minimum versions of LabVIEW and NI-RIO.

Note If you have recently upgraded LabVIEW, you must reinstall NI-RIO.

- Check the USB cable connections at the cRIO-9030 and host computer. Check the Ethernet cable connections at the host computer and router.
- If you have network firewalls or other security software enabled, try temporarily turning them off. You may also need to add an exception for MAX. In Windows 7, select **Start»Control Panel»System and Security»Windows Firewall»Allow a program through Windows Firewall**. Click **Allow another program**, select **Measurement & Automation**, click **Add**, then click **OK**.
- Ensure that UDP port 44525 is open to communication on the host computer. If you are using an intelligent switch on the network, ensure that it is not disabling UDP port 44525.
- Hold down the RESET button for 5 seconds to reboot the target into safe mode. This prevents a real-time app from running. Sometimes a malfunctioning real-time app prevents network communication.
- Check the Device Manager to ensure the National Instruments USBLAN adapter is recognized. In Windows 7, select **Start»Control Panel»Device Manager»Network adapters»National Instruments»USBLAN adapter**. If the USBLAN adapter is not recognized, you must reinstall NI-RIO.

For more information about troubleshooting network communication in MAX, refer to the following locations:

- The *MAX Remote Systems Help*
- *Troubleshooting: I Cannot Find My CompactRIO or Single-Board RIO System in MAX* in the *MAX Help*.
- The *Troubleshooting CompactRIO Controllers in Measurement & Automation Explorer* white paper. Visit `ni.com/info` and enter the InfoCode `TroubleshootcRIOMAX`.

Understanding LED Indications

Figure 1 shows the location of the LEDs on the front panel.

POWER LED

The POWER LED is lit while the cRIO-9030 is powered on. The POWER LED is lit green when the cRIO-9030 is powered from the V1 input, and yellow when the cRIO-9030 is powered from the V2 input.

STATUS LED

The STATUS LED is off during normal operation. The cRIO-9030 indicates specific error conditions by flashing the STATUS LED a certain number of times every few seconds, as shown in Table 2.

Table 2. STATUS LED Indications

LED State	LED Color	Indication
2 flashes every few seconds	Yellow	There is no software installed, which is the out-of-box state, or the controller has detected an error in its software. An error can occur when an attempt to upgrade the software is interrupted. Refer to the *MAX Help* for information about reinstalling software on the controller.
3 flashes every few seconds		The controller is in safe mode. Refer to the *MAX Help* for information about safe mode.
4 flashes every few seconds		The software has crashed twice without rebooting or cycling power between crashes. This usually occurs when the controller runs out of memory. Review your RT VI and check the memory usage. Modify the VI as necessary to solve the memory usage issue.
Continuously flashing		The controller has not booted into NI Linux Real-Time. The controller either booted into an unsupported operating system, was interrupted during the boot process, or detected an unrecoverable software error.
Solid		The controller is booting up.
Continuously flashing	Red	This indicates a hardware error. An internal power supply has failed. Check front-panel I/O and C Series module connections for shorts. Remove any shorts and power cycle the controller. If the problem persists, contact National Instruments.
Off	—	Normal operation.

Note Refer to the *NI cRIO-9030 Operating Instructions and Specifications* for a complete explanation of the front panel LEDs.

Worldwide Support and Services

The National Instruments website is your complete resource for technical support. At ni.com/support you have access to everything from troubleshooting and application development self-help resources to email and phone assistance from NI Application Engineers.

Visit ni.com/services for NI Factory Installation Services, repairs, extended warranty, and other services.

Visit ni.com/register to register your National Instruments product. Product registration facilitates technical support and ensures that you receive important information updates from NI.

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